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PATENT APPLICATION OF

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ENTITLED

HINGED HEAT SINK BURN-IN SOCKET

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HINGED HEAT SINK BURN-IN SOCKET

CROSS-REFERENCE TO RELATED APPLICATION

Reference is made to U.S. patent application
Serial No. 09/920,372, filed August 1, 2001, the
5 contents of which is hereby incorporated by reference
in its entirety.

BACKGROUND OF THE INVENTION

The present invention relates to a burn-in
socket that supports an integrated circuit in
10 position electrically coupled to contacts on a socket
supported connector board in a controlled oven
environment for burning-in or testing the integrated
circuit. Circuit temperature is controlled, in part,
with a socket mounted heater and a heat exchanger
15 comprising radiating fins on a hinged cover that will
open to permit installing the circuit in place, and
afterwards will close easily and clamp tightly to
hold the circuit in proper position.

The use of various types of sockets for
20 holding integrated circuits and which control the
circuit temperature during burn-in has become more
important with the new integrated circuits that
generate high amounts of power and thus heat in use.
It is necessary to control the environment of the
25 integrated circuit during its burn-in phase to ensure
that the circuit is operating properly at various
temperature levels.

Sockets for holding integrated circuits on
burn-in boards have been advanced, but generally have

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problems with rapid, accurate loading, and holding the circuit board in intimate contact with a connector or contact board.

5 A prior art universal test and burn-in socket frame shown in U.S. Patent No. 5,748,007, includes a clamp for an IC module. This is one form of socket that is known in the art for burn-in testing of IC modules. Many of the prior art sockets have some difficulty in loading and clamping, as well
10 as being quite complex, which raises manufacturing cost and operational problems.

SUMMARY OF THE INVENTION

The present invention relates to a frame or burn-in socket that is easily loaded, and has a
15 support base and a hinged cover that carries a heat exchanger, and which when moved into closed position will clamp an integrated circuit chip or module positively against a test contact set. The cover is held down with an over center lock so that the
20 integrated circuit is positively held in intimate contact with the contact set on a circuit board held on the support base. A temperature sensor is held tightly against the integrated circuit chip as well.

The cover is hinged on one side of the
25 burn-in socket support base, and is carried as showing on a sliding frame. The cover will move vertically, or generally perpendicular to the plane of the circuit board carrying the contact set. A cam actuator is used to obtain the vertical movement

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relative to the support base. The cam is operated to claim or release the cover, as shown by moving the sliding frame to raise and lower the cover relative to the support base holding the test contact. The
5 cams are moved when a bail or handle is moved about its pivot.

The hinged cover is mounted on the sliding frame and raises and lowers with the sliding frame. The cover is also hinged open by an actuator arm
10 moved by the cam handle or bail when the cams are actuated to provide for quick loading and unloading of integrated circuits. The cover will open sufficiently to provide clearance of the center portions of the support base where the test contact
15 set circuit board is held and over which the test integrated circuit is placed and held. The cover is latched and held positively when it is closed.

The hinged cover for the burn-in socket provides full access to the printed circuit board
20 having the test contact set or test connectors. The burn in socket is thus easily loaded with an integrated circuit, which is positively held when the cover is closed. Control of the test temperature also is aided with the use of the finned heat
25 exchanger cover.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a burn-in socket made according to the present invention and shown in an open position;

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Figure 2 is a perspective view similar to Figure 1 but with a hinged cover in a closed position;

Figure 3 is a side elevational view of the
5 burn-in socket of Figure 1 in a closed position;

Figure 4 is a front elevational view of the burn-in socket of the present invention with the cover in a closed position;

Figure 5 is a top plan view of the burn-in
10 socket with the cover in a closed position;

Figure 6 is a sectional view taken as on line 6-6 in Figure 5;

Figure 7 is a sectional view taken as on line 7-7 in Figure 4;

Figure 8 is a side elevational view of the
15 burn-in socket shown in with the cover in a raised position;

Figure 9 is a front elevational view of the burn-in socket with the cover in a raised position;

Figure 10 is a sectional view taken as on
20 line 10-10 in Figure 9;

Figure 11 is a sectional view taken as on line 11-11 in Figure 9 and 12; and

Figure 12 is a top view with the cover in a
25 raised position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Figure 1, a burn-in socket made according to the present invention is indicated generally at 10 and includes a support base 12 that

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would be secured in position inside a burn-in oven. The support base can have locating tabs or pins such as that shown at 13 on the lower surface thereof. The support base 12 is generally a plate-like member
5 that is formed in a rectangular shape with an open center recess as shown in Figures 6, 7, 10 and 11, that will support a contact set printed circuit or connector board 14. The contact set or connector board 14 is generally planar and is parallel to a
10 plane of the base.

The support base 12, as can be seen, supports a plurality (four) of corner guide posts 18, that are upright and fixed perpendicular to the support base. These corner posts 18 in turn form
15 sliding guides for a movable sliding frame or clamp 20. The sliding frame 20 has a pair of side members 22, 22 that each have a pair of end sleeves 21. The sleeves of each side member are slideably mounted on a pair of pins 18. The pins 18 are fixed to the
20 support frame. The side members 22 have outer side straps 24 and inner panels 26 that form a cam housing or chamber. A pair of cam reaction bridge members 28, 28 are supported on the support base 12 on opposite sides thereof cap screws 30 that pass
25 through end pillars 20 on the bridge members. The bridge members are spring loaded, as will be explained. The cam reaction bridge members are positioned in the cam housing or chambers formed between the inner panels 26 and strap 24.

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The end pillars 29 support an overhead cam reaction cross member or wall 34, that defines a space between a bottom or downwardly facing, cam follower surface 35 of the respective cross members 34 and the upper surface of the sides of the support base 12. A separate rotatable cam 36 is rotatably mounted on each of side members 22 of the movable sliding frame 20 between the side strap 24 and inner panel 26 of the respective sliding side member 22.

The cams 36 are rotatably mounted with suitable pins 40 to the respective sliding side member 22. The cams 36 are double acting cams which will react to provide a lifting force for the sliding frames against the upper surface 42 of the support base on the opposite sides thereof in alignment with the cams, and also will react against the under surfaces 35 of the bridge cross members 34 to provide a downward load on the pins 40 and thus on the sliding side members 22 of sliding frame 20. The cams are rotated with a bail or handle 37.

The end pillars 29 and thus bridges 28 are spring loaded on cap screws 30 toward the support base 12, as member and as shown schematically in Figure 8. A spring 39 is placed between the underside of heads of the cap screws 30 and retainer flanges 38 surrounding the respective cap screw at the bottom of each pillar 29. The pillars 29 and the bridges 28 are thus urged toward the support base with a spring force and will move away from the

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support base as the cams 36 load the sliding members downwardly and the force is reacted against the bridge surfaces 35.

5 The sliding side members 22 carry an integrated circuit clamp arm 44 that is pivotally mounted on a suitable axis indicated schematically at 48 (Figure 10) on the sliding members 22. The clamp arm 44 extends between the side members 22 adjacent one end of the socket support base 12. The movement
10 of clamp arm 44 about the pivot axis 48 is controlled with a link 50 that in turn has a pair of arms 53 that are pivotally mounted to the clamp arm 44 about a pivot axis 52 (Figure 10). The opposite ends of the arms 52 of link 50 are pivotally mounted as at 54 to
15 a pair of posts 56 that are fixed to the support base 12. It can thus be seen that as the sliding side members 22 are raised and lowered by operating the cams 36, the clamp arm 44 will move in an arc about the pivot 48, and the ends of the clamp arm will also
20 move toward and away from the support base 12 with the sliding side members 22.

Additionally, a socket cover 60 is pivotally mounted on a suitable axis indicated at 62 in Figures 6, 7 and 11, along one end of the support
25 base 12, opposite from the end mounting clamp arm 44. The lower surface of the socket cover 60 is designed to intimately contact an integrated circuit 68 that is supported within an open center recess 70 of the

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base frame 12, above or overlying the contact set printed circuit board 14.

As can be seen in Figures 7 and 10, the cover 60 has a central bore 74 that carries a temperature sensor 78 that is held in intimate contact with the integrated circuit 68 when the cover 60 is closed to the position shown in Figures 6 and 7. The temperature sensor 78 is used for sensing the temperature of the integrated circuit 68 under test.

10 A plurality of heat radiating fins 80 are provided on the upper surface of the cover 60. The cover 60 thus forms a heat sink and heat exchanger. The cover 60 further includes side wall portions 82 and 82A that have clamp lugs 84 and 84A at ends thereof opposite from the hinge axis 62, that protrude or extend outwardly from the free end of the cover 60 a selected amount. The lugs 84 and 84A are closely adjacent to and fit between the inner panels 26 of the sliding members 22.

20 Side 82A of the cover 60 has a cam receptacle guide ear 86 at the hinge end of the cover (Figure 1), and this cam receptacle guide ear 86 has a recess 88 therein which will receive the end cross member 37A of the bail 37 when the bail is moved to its open position as shown in Figure 1, it will hold the cover 60 open. The cams 36 will go over center in the open position to keep the sliding side member 22 of sliding frame 20 raised. The cam guide 88 will

be operable to hold the cover 60 raised while the integrated circuit board 68 is removed or inserted.

When the bail 37 is moved to a closed position, and thus rotates the cams 36, the cams 36 will act against the under surfaces 35 of the bridge cross members 34 of the bridges 28, and will provide a reaction load forcing the sliding side members 22 downwardly, and carrying the cover 60 downwardly as well.

The clamp arm 44 will be moved by link 50 to a position where a lower edge overlies one edge of the integrated circuit 68 under test, and as closing is completed the end portion 45 of clamp arm 44 will clamp against a lip 92 (Figure 7) and hold the integrated circuit against the contact set on circuit board 14 in the closed position of the cover. The cams 36 will go over center as the bail 24 is moved into its closed position shown in Figures 3-7. The clamp plate 66 will move down tightly against the peripheral edges of the circuit board 68 and will clamp it in place. The downward force exerted is controlled by the springs 39 acting between pillars 29 and cap screws 30.

Again, the clamp arm 44 is moved to its position as shown in Figure 7 against the tapered lip 92 on one side of the clamp plate 66, and provides a positive locking force. The clamp lugs 84 and 84A also engage the end portion of clamp arm 44 to securely hold it clamped.

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5 The cross member 24A of the bail 24 is provided with a manual tab 96 that can be used for lifting and lowering the bail as it is manually operated to move between its open and closed positions.

10 It thus can be seen that the hinged cover 60 that carries the heat radiating fins 80, provides a positive clamp against the integrated circuit to hold it into position to contact the contact set on circuit board 14 of the burn-in socket.

15 The cover also carries a cartridge heater (not shown), as well as the temperature sensor 78 for controlling the temperature of the integrated circuit under test. The fins 80 can be subjected to an airflow for cooling when needed.

20 The force of clamping is regulated by the springs 39 that mount the bridge members. The springs 39 react the load from the cams 36 and clamp arm 44 urging the cover 60 to clamp an integrated circuit.

25 Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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